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ASSESSMENT OF INSTRUMENT RELIABILITY AND VALIDITY ON REQUIREMENT REUSE PRACTICES IN MALAYSIA

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ABSTRACT

Requirement reuse came as an alternative method to facilitate the requirement engineering process. It is an approach of making use of existing requirement documents in order to reduce effort requirement elicitation and analysis during software development lifecycle. There are various research works had been done on the implementation of requirement reuse and many had sought to provide a better practice of it. However, the practice of requirement reuse is still uncertain. There is a lack of study to determine the current state of requirement reuse practice in Malaysia. Therefore, an instrument is designed and developed to determine requirement reuse process, challenges, component, and its support tools. This paper describes the design of the instrument used for the survey on requirement reuse practice and the assessment of its reliability and validity. Cronbach's alpha test was used to check on its reliability meanwhile hetero-monotrait ratio (HTMT) criterion was used to check on the discriminant validity. The result from both of the tests shows the item in the questionnaire has a high level of consistency and established discriminant validity. Therefore, based on the results, there are no modifications or amendments made to the questionnaire. Hence, the developed instrument is reliable and has sufficient discriminant validity for further work.

Keywords: *Requirement Reuse, Requirement Engineering, Survey Design, Reliability test, Validity test*

1. INTRODUCTION

Software requirements elicitation and analysis in requirement engineering (RE) are among of the activities conducted in the first phase of software development, which is crucial to the success of software project [1]. The process of requirement engineering consumes high effort from the elicitation process until the end of its cycle in order to manage requirements [2]. The problem domain is deemed as an effort to perceive software system behavior and constraints [3], thus in this case developers must understand the relationship between requirements and its problem domain to ascertain comprehensive knowledge on how the software system works and what it could provide [4]. Ascertaining the right requirements are both important and difficult part in software development [5]. Due to this, requirements reuse aids in requirement engineering process by making use of existing requirement documents or artefacts to reduce effort of requirements elicitation and analysis during software development [6]. The examples of artefacts to be reused during the process includes includes business process, constraints, features, use cases, architectures and data models [8].

The implementation of requirement reuse may help to develop a better software quality and productivity [7], lessen the costs of development as well as accelerates time of software development to market [6] hence increasing the efficiency of requirement elicitation process and ensure the success of software project [9]. Due to the increase of demands and frequent changes in business, requirements is ought be reused than creating new requirements [10]. Significantly, the implementation of requirement reuse is essential to maximize the use of knowledge [9].

Many research works had been done by past researchers on developing an approach for requirement reuse, which includes as software requirements catalog (SRC) [7], real-time systems

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[10], software product lines (SPL) [11, 12], ontologies [13, 14, 15, 16] and meta-modeling [17, 18], pattern repository [19] and object-oriented [20]. However, the practice of reusing the requirements still remains uncertain, and most often were restricted to small-scale academic [14]. Furthermore, there is a lack of study in exploring the current state of requirement reuse practice in software industry in Malaysia.

Hence, this motivates the study to determine the current state-of-the-art of the requirement reuse practice in Malaysia. The research is distinct from prior work as it focuses on exploring the current requirement reuse practice on its processes, challenges, component, and support tools through a survey among software practitioners in Malaysia's software industries. The findings from the survey will be valuable to provide insight to the current state-of-the-art of requirement reuse practice in Malaysia. Therefore, prior of conducting the survey, in this paper, an instrument to assist for the survey is designed, developed and validated through a small-scale pilot test to assess its reliability and validity. The results from this paper will present the acceptability and suitability of the instrument measurement properties to be used for actual survey.

The structure of this paper starts with background studies and related work in requirement reuse, research methodology for the study, a discussion of the survey results on its reliability and validity and lastly concluded with a summary.

2. BACKGROUND STUDIES AND RELATED WORK

Requirement reuse practice rises in the 90s to assist for requirement engineering (RE) in order to help improving the quality and productivity of software process and products [7, 21]. It also assists in generating better quality requirements [19] and helps organization to save resources in requirements specification phases [20]. In particular, the final quality of the software depends on the quality of the requirements [22]. Hence, requirement reuse is sought to be the key to acquire a better quality of requirements through an effective requirement engineering mechanism [21]. Therefore, in the next section, we discussed on the approaches used by past researchers for requirement reuse as well as its benefits and challenges in implementing the practice.

2.1 Requirement reuse approaches

Various research work has been done concerning to requirement reuse practice over the decades. Hence, there are several requirement reuse approaches discussed and proposed by past researchers such as software requirements catalog (SRC) [7], real-time systems [10], software product lines (SPL) [11, 12], ontologies [13, 14, 15, 16] and meta-modeling [17, 18], pattern repository [19] and object-oriented [20].

The researchers in [7] proposed a model of requirement reuse in requirement catalog. The model involves three phase of requirement reuse such as creation, management and maintenance phase. It contains the guidelines to reuse the requirements through four activities such as searching, selecting, adapting and implementing. The model is successfully implemented in small-size organization and helps to reduce their effort and development time of software project. The study also proved that implementation of requirement reuse through the method helps improving and obtaining better and quality requirements as well as promoting a more effective practice of requirement reuse.

In [10], the researchers applied adjustable requirement reuse mapped from the company repository to the project repository. The adjustments allow wordings improvements on the requirements, adjustments on specific value or parameters as well as adjustments from users that may have comments in regards to customers or market. This approach allows the projects to produce the requirement of their own. The approach increases the work efficiency as the adjustable method requires less effort to build up a structure and the requirement also may evolves and can be changed throughout time.

Further, in [11], the researchers proposed an approach to provide automated support to extract the reusable requirements easily with less effort techniques. The approach works through extracting the requirements in product line by examining the linguistic characterization of domain's action-oriented and their variability. In [12], the researchers manage the requirement specifications that focused on natural language in software product line context to implement requirement reuse. It works by linking the requirement statements, use cases and its specifications to

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features in a feature model. The feature model is use a mean for managing the variability among the product line requirement. From the case study conducted, the approach works better than existing clone-and-own approach for requirement reuse. Product line approach helps to enhance the implementation of requirement reuse among practitioners as they may work closer on the abstractions to the initial domain concept [11].

For requirement reuse using ontology-based approach, in [13], the researchers utilize Knowledge-assisted Requirement Evolution (K-RE) from a generic knowledge base (KB) for requirement reuse. The knowledge base contains requirements knowledge such as business constrains, features, processes, use cases and data models that are enable to be enhanced, modified and used for future project. K-RE assists in extracting domain knowledge from semi-structured or unstructured knowledge in order to produce a structured knowledge base comprises of requirements that can be reused. The approach helps in achieving complete, consistent and rich requirement specifications. Meanwhile, the researchers in [14] developed an automation support tool for the implementation of requirement reuse and documentation. The tool supports interaction with users through graphical user interface (GUI) that assists users for decision-making and evaluate the validity of user-centered data against domain constraints to ensure valid product and requirements. Through the case study conducted using the tool, the findings shows that the tool is applicable to be used and helps increases the quality of requirements and reduces the effort of documenting the requirements in a long term. On the other hand, the researchers in [15] developed a generic model used as a blueprint for the instantiation of an organization-specific software requirement specification repository. The reuse of information and knowledge sources is through a proper instantiated model and its software requirement specification repository. The model allows queries of desired information and provides comprehensive and consistent software requirement specification. Hence, less effort is required for practitioners to determine, compare and combine the requirements to be reused. In [16], the researchers proposed an ontology-based approach that enable enhancement of requirement reuse implementation through acquisition of both static and dynamic view of software project. The approach provides analysis of stored requirements and detection of missing or incomplete requirements. Significantly, it helps in reducing efforts for elicitation of software requirements.

In [17], meta-model approach is adopted to develop a mechanism to implement requirement reuse. Meta-model provide specification in which modeling process need to fulfill. It is a component of every system design problems. The approach proposed in the study using the adoption meta-model enables a systematic requirement reuse strategy by linking the concepts of requirement engineering (RE), model-driven engineering (MDE) and software product line engineering (SPLE). The meta-model consists of software requirements pattern, variability modeling and traceability that allow enhanced systematic reuse application in order to reach full benefits of requirement reuse towards improving software quality and productivity. Meanwhile, in [18], the researchers proposed requirement engineering meta-model that aim to support requirement reuse through repository and also developed a studio graphical modeling tool that support the model by allowing specification of defining catalogs of reusable requirement models for reuse and defining specific product requirements by reusing previously defined models. The model allows requirement engineers to define optional and parameterized requirements, which enables the variability inclusion to textual specifications as well as allowing the designers to reuse the requirements model. Using the model, information variability can be directly included into the requirement models thus overcoming the limitation of existing approach that deals with textual requirements.

Meanwhile, in [19] the researchers utilized requirement pattern repository to implement requirement reuse by adapting the pattern of existing requirement in repository. The approach assists practitioners to create, adopt and adapt requirements pattern to be reused. On the other hand, in [20], the researchers applied object-oriented thinking for requirement reuse implementation through a reusable library containing requirements templates. The requirements are expressed in programming language through a code form. This approach helps reduces the effort of developers to switch their tools, the issues of lack well-defined reuse method and low quality of requirements.

However, the practice of reusing the requirements is still uncertain, as the practices were

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restricted to small-scale academic and is yet to be explored in large industry or commercial generalization [14]. Its implementation is still uncertain in the industry and there are also challenges and constraints that might affect its implementation [22]. Moreover, the practice of industrial project often involves little reuse of requirements [20]. In particular, reuse is not fully optimized at the highest level of abstraction in software development such as in requirement analysis phase since it most often applied at lowest abstraction level such as in design and implementation phase, therefore due to this, limits its benefit of providing less effort for software development [17].

2.2 Benefits and challenges of requirement reuse

The implementation of requirement reuse may gives many benefit to the practitioners as it does not only speeds up the time of software development, it also improves the quality of software produced. Moreover, requirement reuse provides opportunity for organization to develop a better software quality and productivity [7]. Furthermore, it also reduces the costs of software development and accelerates time required for software to be fully developed to market [6]. The flexibility of requirement reuse practice allows its application to be applied at any phase of requirement engineering [18]. Granted that, its implementation may increase the efficiency of requirement elicitation process thus ensuring the successfulness of software project [9]. In addition, it also maximizes the use of knowledge during software development [9], reduces risks [23] and provides chances to develop project consistently with minimum tendencies to errors [18]. However, despite its benefits, there are also challenges that may affect its implementation.

In [22], the researchers proves the presence of requirement reuse practice in organization but the implementation necessitates a more mature and well-defined reuse method and process as the requirement reuse practiced by most of the requirement engineers is applied in a manual and simple method such as copy & paste. The researchers also had identified several challenges that affect the implementation of requirement reuse, which includes the organization lack of knowledge and skills on incorporation as well as high initial investment for its implementation. The survey also revealed that the constraints of implementing requirement reuse practice are due to the lack of awareness of reuse techniques and processes, costly investment and complexity of reuse process. Meanwhile, in [24], the researchers discovered that there is a time reduction in the development by applying requirement reuse in the same family project as it helps to reduce effort in requirement engineering process to acquire quality specification.

Furthermore, the findings from survey in [26] revealed that half of the respondents agreed that the practice of requirement reuse helps in accelerating the time of software to market however the challenges of its implementation were due to poorly structured and maintenance of existing requirements. Thus, the researchers suggested the organization to refactoring existing requirements, maintaining a complete requirements model through releases, separating the stakeholder and product types, and establish change impact analysis in reuse practice in order to enhance requirement reuse implementation. Researchers in [27] conducted a survey conducted among software practitioners in Malaysia on the factors that influence software practitioners to practice requirement reuse. The findings revealed that there are high agreement on the intentions to practice requirement reuse in a project, however, there are also factors that contributes to inhibit its practice. The factors include unavailable tools to support reusing the requirements, unacceptable conditions of the requirements and lack of guidance for requirement reuse practice. However, the survey only focused on the factors that influence software practitioners to practice requirement reuse and does not focus on the current state-of-the-art of requirement reuse practice.

From the literature, notably, there is lack of studies that explores on the current requirement reuse practice among software industry in Malaysia. Hence, this motivates the research to explore the current state of requirement reuse practice among software practitioners in Malaysia's software industry. The significance of the research helps to determine the requirement reuse process, challenges, component, and its support tools through a survey among software practitioners in Malaysia. The research is different from the survey on requirement reuse in Malaysia discussed in [27] as the work only focused on identifying the factors of the requirement reuse practice Malaysia's software industries.

Prior of conducting the survey, an instrument to assist for the survey should be designed, developed and validated to ensure its

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measurement properties acceptability. Therefore, in this paper, the instrument for the survey is designed and validated to determine its acceptability on its measurement properties through conducting a pilot study. The findings from the results of the pilot study will help in ascertaining the suitability and acceptability of the instrument measurement properties in order for the instrument to be used for the actual survey.

3. MATERIAL AND METHOD

A structured questionnaire had been designed and developed as for the survey's instrument. According to researchers in [25], the validity of the research instrument can be enhanced through adopting previously tested and developed measures. Therefore, several questions and answer options in the survey were adopted from [22, 26] with few modifications made to meet six research questions as described in Table 1.

Table 1: Research Questions

No.	Research Questions
1	How requirement documents are prepared and what are the challenges?
2	What are the current states of requirement reuse practice among requirement engineers?
3	How does requirement reuse usually implemented in a project?
4	Which requirement groups were usually reused in a project?
5	Which component of the requirement is important in implementing requirement reuse?
6	What are the factors and challenges that influence the implementation of requirement reuse in a project?

The research questions generally covers on the identification of the current state of requirement reuse practice as well as exploring on the requirement reuse process, challenges, component, and its support tools. Thus, in order to seek answer to the following research questions, an instrument is designed and developed using a structured set of questionnaire. To validate the instrument developed, an assessment of reliability and validity is done to determine its suitability and validity prior of conducting an actual survey.

3.1 Instrument Design

The research design is quantitative. Survey questionnaire and experiment are two main research designs to perform quantitative research [28]. Hence, to conduct a survey, an instrument is designed and developed using a structured set of questionnaire.

The instrument developed to assist for the survey is a structured questionnaire, which consists of 27 questions that were divided into three parts. Part I consists of questions related to the respondent's background, Part II consists of questions related to requirement engineering and Part II contains questions related to the requirement reuse practice. Essentially, all of the questions in Part II relates with the research question 1 meanwhile questions developed in Part III aim to sought answers to research questions 2, 3, 4, 5 and 6. The type of answer options for the questionnaire ranges from a "yes" and "no" question, multiple-choices, checkboxes, and rating using a 5-point Likert scale where '1' indicates 'totally agree', '5' indicates 'totally disagree' and '3' indicates 'neutral' opinion towards the statement.

The questionnaire was designed using an online survey platform, Google Form. In part I of the questionnaire, standard demographic questions such as age and gender were included. Other questions includes respondent's work experience, their role and number of projects involved as well as size of their organization to ensure the sample is valid for analysis. Meanwhile in Part II concerns on requirement engineering and Part III covers practices of requirement reuse.

3.2 Pilot Study

Prior of conducting a survey on the current state of requirement reuse practice among practitioners in software industry in Malaysia, a small-scale pilot test was done. The purpose of pilot study is to investigate the issues of the primary data collection before proceeding to conduct a large-scale primary data collection. In particular, the objective of pilot study is to assess the reliability and validity of the questionnaire as well as to determine if the respondents understand the questionnaire items. The reliability and validity of the instrument will be assessed to check the consistency of a set of measurements. The main focus of the study was to collect responses from individuals who have experience in handling

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requirement documents in Malaysia software industries.

The followings were carried out during the pilot study: Firstly, the questionnaire survey was made available online using Google Form. Then, the link to the questionnaire is distributed to potential respondents through invitation emails and application messenger. The invitation was sent to individuals who worked in the software industries in Malaysia. The online survey was made accessible for two weeks. Then, the responses were analyzed using SPSS software for reliability and validity tests.

There were a total of 31 respondents involved in this pilot study, 58.1% are female and 41.9% are male. Overall, the respondent's age range from 20 to 40 years old. Most of them had worked in the software industry for less than 5 years. Majority of them are programmers. Almost half of them work in a small size company that has less than 100 workers. Most of the respondents had only participated in less than 5 projects.

We had discussed the results from respondent feedback to assess the level of understanding, level of difficulty in responding and level of relevancy to a subject area and the duration taken to complete the questionnaire in [28]. In this study, a test is conducted to check on the reliability of the questionnaire items using Cronbach's Alpha reliability test and hetero-monotrait ratio (HTMT) criterion is used to check on the validity of the instrument. Both of the tests are conducted using SPSS software. Based on the responses collected from pilot study, assessment of the instrument on its reliability and validity were conducted hence the results are presented.

4. RESULTS AND DISCUSSION

This section discusses on the results of the reliability and validity tests conducted on the instrument used in the pilot study. It presents the summarized findings and results performed. In this study, we focused on assessing the reliability and validity through the responses of pilot study in order to determine its suitability, consistency and validity.

Testing the accuracy of the questionnaire designed is important to ensure the utilized items are valid and effectively replicate the basic theoretical constructs [29]. Through automated Google Form responses feature and analysis component in SPSS software, basic quantitative data analysis was done for the assessment. The detail descriptions of the tests conducted are presented in the following sections.

4.1 Instrument Reliability

Reliability refers to the internal consistency of measurement for a construct by a set of indicators. It is also an assessment of instrument quality, which is used to check on the consistency of a set of measurements. Cronbach's alpha is used to check the reliability of construct and the acceptable critical value is 0.7, moreover, the values above 0.8 are considered better [30]. Therefore, the closer the value of Cronbach's alpha to 1.0, the higher the internal consistency of the items. On the other hand, low Cronbach's alpha values means there are poor consistencies between items. Normally, the test is considered reliable when the same outcome repeatedly is achieved [31].

As shown in Table 2, the value of Cronbach's alpha for question 3 in part II of the questionnaire is 0.824, for question 3 in part II is 0.887, for question 13 in part III is 0.911 and for question 14 in part III is 0.859. All of the analysis shows a total of internal consistencies above adequate reliability of 0.7. Therefore it can be concluded that there are high level of consistency among the items in each questions hence the items questions possess a high reliability thus can be used for further analysis.

Table 2: Instrument Reliability Test

Questions	Cronbach's Alpha	No. of Items	CA>0.7
Question 3 part II	0.824	6	Acceptable
Question 4 part II	0.887	8	Acceptable
Question 13 part III	0.911	6	Acceptable
Question 14 part III	0.859	11	Acceptable

4.2 Instrument Validity

Discriminant validity is the extent to which a construct is truly distinct from other constructs [32]. It also refers to the extent to which a construct is truly distinct from other construct [30]. According to researchers in [33], the usual Fornell-Larcker criterion, the leading method for

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discriminant validity test does not reliably determine the lack of discriminant validity in most of the studies. Hence, the researchers proposed on using hetero-monotrait ratio (HTMT) to assess the discriminant validity issues, which is based on multitrait-multimethod matrix.

To assess the discriminant validity, we have selected hetero-monotrait ratio (HTMT) of correlations to check on the discriminant validity of questionnaire for question 3 and 4 in part II, and question 13 and 14 in part III which utilizes Likert-point scale. It is strongly recommended to draw the HTMT criteria for discriminant validity evaluation [32]. It is suggested that HTMT value in the range of +1 to -1 meaning that the two construct were distinct and HTMT value which is less than 0.85 is the most conservative value criterion HTMT value to conclude that the discriminant validity is established [33].

In this study, the selected hetero-monotrait (HTMT) criterion is used to check on whether each items developed for each questions is truly distinct from another. This is to ensure that no any items represent the same meaning in order to avoid and reduce redundancy. In brief, to summarize the findings, we utilized the most conservative value criterion HTMT value, which is less than 0.85 to conclude that the discriminant validity is established for each questions.

Hence, the findings in this study presented the hetero- monotrait ratio (HTMT) matrix results analyzed and gathered from SPSS software for each questions, which shows an overview of HTMT criteria for the assessment of discriminant validity of each questions in order to analyze the values of HTMT in the matrix.

For question 3 in part II, the discriminant validity analysis is to ensure the common problems during requirements engineering are truly distinct from each other. There are six items developed for each problem for question 3 in part II. The items and its descriptions are represented as in Table 3.

Table 3: Items description in Question 3 Part II

Items	Description
REP1	Stakeholders did not know exactly their needs
REP2	There were conflicts among the needs stated by stakeholders
REP3	The needs stated by stakeholders changed during the requirements elicitation process
REP4	There was too much time spent in requirements elicitation
REP5	The time invested in requirements elicitation was too little
REP6	Some requirements were missing at the end

From the test, the result shows the value of HTMT ranges from 0.132 to 0.65, which are less than 0.85 as shown in Table 4. This shows none of the HTMT criteria shows discriminant issues for inter correlations. Therefore, we can conclude that the discriminant validity is established for questions 3 in part II.

Table 4. HTMT Criteria for Question 3 Part II

	REP1	REP2	REP3	REP4	REP5	REP6
REP1						
REP2	0.594					
REP3	0.601	0.489				
REP4	0.651	0.641	0.645			
REP5	0.132	0.390	0.067	0.181		
REP6	0.539	0.484	0.592	0.645	0.399	

For question 4 in part II, the discriminant validity analysis is to ensure the common problems during requirements specification documents built in projects are truly distinct from each other. There are eight items for questions 4 in part II. The items are represented as Table 5.

Table 5. Items description in Question 4 Part II

Items	Description
RSDP1	Ambiguity
RSDP2	Incompleteness
RSDP3	Inconsistency
RSDP4	Lack of prioritization
RSDP5	Non-verifiableness
RSDP6	Lack of traceability
RSDP7	Lack of uniformity
RSDP8	Lack of quantification

From the test, the result shows the value of HTMT range from 0.075 to 0.729, which are less than 0.85 as shown in Table 6 in Appendix. This shows none of the HTMT criteria shows discriminant issues for inter correlations. Thus, we

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can conclude that the discriminant validity is established for questions 4 in part II.

For question 13 in part III, the discriminant validity analysis is to ensure factors affecting the implementation of requirement reuse in a project are truly distinct from each other. There are six items for questions 13 in part III. The items are represented as Table 7.

Table 7. Items description in Question 13 Part III

Items	Description
RRF1	Faster "time to market"
RRF2	Reduced maintenance cost
RRF3	Increase product quality
RRF4	Similarity of applications
RRF5	The quality of existing requirement
RRF6	Good structure and level of abstraction of the existing requirement

From the test, the result of hetero-monotrait ratio (HTMT) as shown in Table 8 matrix shows the value of HTMT ranges from 0.289 to 0.829, which are less than 0.85. This shows none of the HTMT criteria shows discriminant issues for inter correlations as the maximum value of HTMT shown in the matrix is 0.829. Thus, we can conclude that the discriminant validity is established for question 13 in part III.

Table 8. HTMT Criteria for Question 13 Part III

	RRF1	RRF2	RRF3	RRF4	RRF5	RRF6
RRF1						
RRF2	0.625					
RRF3	0.381	0.545				
RRF4	0.737	0.557	0.289			
RRF5	0.829	0.719	0.533	0.808		
RRF6	0.752	0.798	0.451	0.656	0.783	

For question 14 in part III, the discriminant validity analysis is to ensure the challenges in implementing requirement reuse are truly distinct from each other. There are eleven items for questions 14 in part III. The items are represented as Table 9 below.

Table 9. Items description in Question 14 Part III

Items	Description
RRCH1	The project team did not feel that reuse is important and worth the effort
RRCH2	The project did not support requirement reuse
RRCH3	The requirement development in previous release were incomplete (or do not exist) making it impossible to reuse them
RRCH4	The existing requirement were poorly structured, therefore it is difficult to identify which requirement can be reuse
RRCH5	The existing requirement are not kept updated which make them difficult to reuse
RRCH6	The projects were very different one from another
RRCH7	Unsuccessful trial from previous project
RRCH8	Requirement reuse was considered as complex
RRCH9	The companies think that think it would not bring any benefit in the long run
RRCH10	The initial investment was too high even if it brings benefit
RRCH11	The companies did know how to implement requirement reuse

The result of hetero-monotrait ratio (HTMT) matrix as shown in Table 10 in the Appendix shows the value of HTMT ranges from 0.039 to 0.685, which are less than 0.85. This indicates that none of the HTMT criteria shows discriminant issues for inter correlation as the maximum value of HTMT shown in the matrix is 0.685. Thus, we can conclude that the discriminant validity is established for question 14 in part III.

In summary, based on the overall result of discriminant validity tests conducted, all of the values revealed that HTMT values are below 0.85. None of the HTMT criteria shows discriminant issues for inter correlations, thus we can conclude that the discriminant validity has been established. Thereby, the discriminant validities for the questionnaire in this study are acceptable. Therefore, due to this, there are no modifications or amendments made to the questionnaire.

Therefore, from the results of both tests on the assessment of reliability and validity of the instrument, the findings shows that the instrument has high reliability values thus confirming the consistency of items in the questionnaire as well as has established discriminant validity, proving the items of construct are truly distinct from one another. This indicates that the developed instrument is reliable and has sufficient discriminant validity for further work. For this reason, there are no modifications or amendments made to the questionnaire.

From the findings, the instrument that has been designed and developed for the study was successfully validated through the pilot study. The result shows the instrument acquired acceptable measurement properties to assist for empirical study in order to achieve the research aim. This proves the suitability of the instrument to be used for the empirical study. Hence, the instrument can be utilized to conduct a survey among software practitioners to determine the current requirement reuse practices in Malaysia.

The validated instrument will be used for future work to assist for conducting empirical study in exploring the current requirement reuse practices in Malaysia, which is distinct from the previous literature discussed in [27]. The survey conducted in [27] concentrates on exploring the factors that influence the requirement reuse practice in Malaysia that overlooks the current state-of-the-art of requirement reuse practice. Therefore, instrument that has been developed and validated in this paper will assist the research to explore more on determining the current practice of requirement reuse in Malaysia's software industries in term of its process, challenges, component and support tools. The findings from this paper helps to provide new direction to assist in the exploration of the current requirement reuse practice in Malaysia.

5. CONCLUSION

Overall, this paper had describes the design of the instrument used for the survey on requirement reuse practice in Malaysia and the assessment of the instrument on its reliability and validity. The study had conducted a pilot study to validate the instrument to be used for the survey. The results from the pilot study are then used for the assessment of reliability and validity. The main purposes of the assessment are to determine if the respondent understands the questionnaire and validate the set of measurements used in the instrument. From the results, the internal consistency of the questionnaire is established for having acceptable values of Cronbach's alpha. Furthermore, the discriminant validity test on the questionnaire also reveals sufficient discriminant validity.

Thus, it can be concluded that the instrument has high internal consistency and sufficient discriminant validity, which possessed acceptable measurement properties to assist for empirical study. Therefore, the instrument will be used for further work on conducting a survey of the current requirement reuse practice on its process, challenges, component, and its support tools among software practitioners in Malaysia. The findings from this paper helps in aiding the research to develop a reliable instrument that helps to explore the state-of-the-art of requirement reuse practice in Malaysia. Further studies will be done to conduct a survey using the validated research instrument in order to answer the proposed research questions and summarize the current practices of requirement reuse practices among software practitioners in Malaysia's software industry.

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APPENDIX

Table 6. HTMT Criteria for Question 4 Part II

	RSDP1	RSDP2	RSDP3	RSDP4	RSDP5	RSDP6	RSDP7	RSDP8
RSDP1								
RSDP2	0.587							
RSDP3	0.524	0.594						
RSDP4	0.075	0.585	0.500					
RSDP5	0.264	0.422	0.551	0.465				
RSDP6	0.239	0.492	0.385	0.391	0.633			
RSDP7	0.492	0.729	0.504	0.482	0.466	0.771		
RSDP8	0.390	0.423	0.418	0.396	0.625	0.712	0.574	

Table 10. HTMT Criteria for Question 14 Part III

	RRCH1	RRCH2	RRCH3	RRCH4	RRCH5	RRCH6	RRCH7	RRCH8	RRCH9	RRCH10	RRCH11
RRCH1											
RRCH2	0.535										
RRCH3	0.357	0.485									
RRCH4	0.145	0.075	0.598								
RRCH5	0.469	0.570	0.635	0.602							
RRCH6	0.111	0.513	0.668	0.447	0.486						
RRCH7	0.176	0.529	0.570	0.090	0.363	0.543					
RRCH8	0.254	0.213	0.274	0.342	0.269	0.126	0.260				
RRCH9	0.316	0.116	0.454	0.202	0.039	0.241	0.450	0.598			
RRCH10	0.260	0.228	0.274	0.258	0.251	0.241	0.245	0.658	0.685		
RRCH11	0.180	0.207	0.560	0.312	0.235	0.441	0.482	0.313	0.606	0.547	